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of electricity upon solutions and relative deliquescent tendencies of salts. There is, of course, a good deal about crystallography. In the absence of the laboratory note-books, only parts of some of the tabulated results have been found. One set of experiments, chiefly with common salt, led to the conclusion that the freezing points of solutions are lower in proportion to the amount of the dissolved body. Even the most insignificant experiments were carried out quantitatively.

In Lomonosoff's laboratory, a good deal of special apparatus was devised. Measurements of the coefficient of expansion of air had been made, and a value (recalculated to  $1^{\circ}$  C.) of 0.003 (in place of 0.00367) was found. This led to the construction of an air-thermometer for measuring low temperatures. Incidentally, he reformed the Delisle scale of temperatures, which ran downwards from  $0^{\circ}$  at the boiling point of water to  $150^{\circ}$  at the freezing point, by simply inverting it ( $0^{\circ}$  L. =  $0^{\circ}$  C.,  $150^{\circ}$  L. =  $100^{\circ}$  C.). A thermostat for ice and water was employed in some experiments, and instruments for the study of oceanography, devised by him, came afterwards into general use. One of the most extensive pieces of work done in his laboratory was a study of colored glasses and mosaics, the results of which led to the establishment of a factory, still in successful operation, near St. Petersburg.

The achievements of Lomonosoff outside of chemistry were as remarkable as those within that science. He wrote a treatise on metallurgy, made investigations in meteorology and especially atmospheric electricity, in geology, and in mineralogy, and he assisted in the equipment of expeditions for geographical exploration. He observed the transit of Venus of 1761, and drew from his observations the

conclusion that the planet had an atmosphere "similar to, and perhaps greater than that of the earth," a discovery generally attributed to Schröter and Herschel (1791).

No undertaking that required courage and originality was outside the comprehensive sphere of his interests. He was the first to attempt to apply modern forms to the writing of poetry in the Russian language, and was the author of odes, poems, and even of tragedies to be performed in the Court Theater. He prepared a Russian grammar and a treatise on rhetoric. He devised a vocabulary for expressing scientific conceptions, and his terms are those now in use in Russia. As the most prominent Russian man of science of his time, public affairs claimed much of his strength. Taking him all in all, the rediscovery of Lomonosoff has added at once a chemist of the first magnitude and a personality of marvelous force and range to the limited gallery of the world's very greatest men.

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*THE AMERICAN ASSOCIATION FOR THE  
ADVANCEMENT OF SCIENCE  
THE CAUSE OF HIGH PRICES*<sup>1</sup>

IF the student of present-day affairs should classify the reasons for existing discontent, he would certainly give to the high cost of living a position in the front rank. Dominant political parties, ruling ministries, national policies and local conditions are indiscriminately blamed, yet the phenomenon of high prices is manifest among all progressive nations and in a degree throughout the whole world. It is in evidence in all countries regardless of tariff policy and monetary standards. It is also

<sup>1</sup> Address of the vice-president and chairman of Section I, Washington, 1911.

apparent under all forms of government. If there is any one class of countries in which the phenomenon attracts less attention it is in those which are least advanced in civilization. Obviously many of the causes to which this general rise in prices has been ascribed must be fallacious because of its universal prevalence.

In explaining the causes it is essential to recognize three fundamental facts, very obvious in their nature, but not so readily understood in their bearing upon the present situation:

1. The rapid progress made by leading nations in modern times.

2. The striking inequality of this progress in different branches of human endeavor.

3. The inevitable tendencies in every progressive era to overaction in enterprise and to extravagance and waste in expenditure.

The second and third facts are subordinate or incidental to the first and closely associated with each other. Let us explain the effect of each in its order.

1. Notwithstanding long periods of inertia and even of retrogression, the dominant note in the history of the race has been that of progress; this has been especially true in the last 100 years. Scientific progress has always been in the van, followed by material, intellectual and political progress. Science has given to mankind a constantly increasing control over nature. Inventions and discoveries have greatly multiplied the supply of useful articles adapted to satisfy human wants. As a result, the convenience and luxuries of one generation are regarded as necessities in the next. One marked effect of this progress is the alleviation of the struggle for existence, with the resulting leisure or opportunity to acquire greater skill and to discover new methods of production. The

requirement of less effort for obtaining the necessities of life gives a wider scope to human enterprise and makes it possible to multiply the achievements which contribute to the betterment of the race.

Nothing is more apparent than that the average per capita consumption is constantly increasing, not merely in essential food products, but in a variety of useful articles which are now available for more general use. Some tables prepared by the late Professor Richmond Mayo-Smith set forth clearly the increased consumption of divers articles in several countries of Europe in periods of 20 to 25 years:

ANNUAL CONSUMPTION PER CAPITA IN DIFFERENT COUNTRIES IN DIFFERENT YEARS

Article and country	Date	Date	Increase Per Cent.
Meat, France .....	25.9 kilos	33 kilos	27.41
	1868	1890	
Meat, England.....	100.5 kilos	124.5 kilos	23.88
	1871-75	1891-95	
Tea, Germany.....	.02 kilo	.05 kilo	150.00
Petroleum, Germany....	3.75 kilos	14.82 kilos	295.2
	1871	1896	
Flour, United Kingdom.	150 lbs.	257 lbs.	71.33
Tea, United Kingdom...	3.91 lbs.	5.77 lbs.	47.57
Eggs, United Kingdom.	12.6	40	217.46
Butter and margarine...	4.7 lbs.	11.1 lbs.	136.17
Cocoa .....	.23 lb.	.62 lb.	169.56
Bacon and ham.....	3.4 lbs.	15.9 lbs.	367.64
Refined sugar .....	5.28 lbs.	41.53 lbs.	686.55

It may be noted that modern means of communication, the ready transmission of news and the increasing scope of industrial and commercial operations have brought about a solidarity of interest among nations and rendered it easy to obtain by international trade useful articles even from the remotest parts of the earth. These same forces have promoted political progress, the assertion of popular rights and a greater equality of opportunity. One effect of this has been that wealth and the consequent increase of average consumption are no longer limited to a few.

The development of a more peaceful disposition among nations has caused a great increase in both production and consumption. Human effort has been less occupied with warfare and more with the development and utilization of the world's resources. All these factors make possible a rising standard of living which increases prices, unless there is equal progress in the various branches of production.

2. Progress, however, has been notably unequal in the different branches of endeavor which supply human wants. It is necessary to keep in mind the difference between a rise in the price of certain classes of products and a general rise in the price level, to which reference will be made later. There is a substantial distinction between these two phenomena. New methods in industry and commerce are revolutionizing the means for supplying human wants, but their effect is far more helpful in some categories of products than in others. Whether this be the result of natural conditions or limitations upon our knowledge is not pertinent to this inquiry. The fact is obvious. Throughout all periods, notwithstanding changes in fashion and taste, there has existed a demand amounting to a necessity for certain essential products, such as food, clothing and shelter. It is evident that science, working through inventions and improved methods, has not accomplished the same results in agriculture, especially in producing food supplies, as in manufacture. The revolution in industrial methods and in the utilization of capital in large scale operations has not been accompanied by equal progress on the farm. Very considerable progress has been made, it is true, in carrying agricultural products to the market and in preserving them for use, but these pertain to transportation and to the middleman rather than to the original producer. Accord-

ingly, as we should expect, the prices of farm products have risen much more rapidly than the prices of manufactured articles. In a very valuable report of the Chief of the Bureau of Statistics for the Department of Agriculture for the year 1910, a comparison is made between the increase in the prices of articles purchased by farmers during the ten years from 1899 to 1909 and the increase in the value per acre of that which the farmers sell. For the articles purchased the average increase was 12.1 per cent., while the average rate of increase in the value per acre of that which the farmer sells was 72.7 per cent., or six times as much. The comparison is made even more emphatic when it is noted that among the articles purchased by farmers flour and lard show maximum, or nearly maximum, increase in prices in response to the higher prices obtained for wheat and hogs. To this rise in the price of articles of food there is one general exception, namely, the price of tropical or semi-tropical products, most of which show a decrease for reasons which do not exist in the case of products of the temperate zone.

The rise in the prices of agricultural products in the temperate zones is well illustrated in the case of raw materials used in the manufacture of clothing. Until this present year the price of cotton had shown a steady increase. The price of middling cotton per pound in the year 1895 was 7.44 cents in the New York market; in 1903 it was 11.18 cents; in 1910, 15.11 cents, or twice as much as fifteen years before. The price of fine wool in the month of January, 1895—for most of which year there was no duty—was in the eastern markets  $17\frac{1}{2}$  cents; in 1903, 30 cents, and in 1910, 36 cents. It may be added that cotton and woolen cloth in their various forms show a much less increase in

price than the raw products from which they are made.

The same general facts are true with relation to cereals and all other food products of the temperate zones. A cause additional to the lesser degree of assistance from invention may be found in the greater scarcity of land suitable for profitable cultivation and in our own country especially the early cultivation of fertile areas was conducted with too much regard for immediate returns and consequently little attention was paid to permanent productive quality. It is of course plain that farm products as well as all articles show an increased price by reason of the greater cost of wages and of most of the supplies which farmers must use. This, however, is common to all branches of production.

The unequal development in different lines of production has of late become especially noticeable in the case of precious metals. Formerly success or failure in gold or silver mining was largely a matter of chance. Now, however, as a result of the discoveries and improvements in engineering, and much more in chemistry, gold or silver mining has assumed the position of a settled industry in which calculations of the profitableness of treating certain ores or digging along a lode may be made with a fair degree of certainty. It may be added that improvements in production are unequal not only as regards different classes of useful articles, but also for different articles of substantially the same class. This is true of various lines of manufacture, hardly any two of which have been affected in the same degree. The manifest effect of this inequality in the ease or difficulty of production is a change in their relative value.

3. There is an inevitable tendency toward overaction, misdirected energy, waste and extravagance in every progressive era.

This tendency has its roots in the very characteristics of human nature itself. It is due in part to the measure of uncertainty which pertains to all business undertakings and in part to the ambitions and dispositions of men. Whenever a new process is invented for satisfying a human want or a new market is discovered, it is probable that the inviting prospect of gain will cause an undue amount of investment and effort in that new direction, which results in a loss of capital and an over-supply of certain articles. The tendency to waste and extravagance is even more marked in the utilization of new facilities or the purchase of articles which please the taste or fancy. It is a well-known fact that the desire for the automobile has caused many persons to invest in this new luxury who could not afford it. A new style of house, or equipage, or of dress, all of which are common in a time of increasing wealth often lead to the discarding of that which under less favorable circumstances would be regarded as sufficient and to the purchase of other articles in accordance with present-day tastes or fashions. Social ambitions and the desire for luxury tend in the same direction; extravagance grows as facilities and attractive articles multiply. Along with these factors is the desire for ease and luxury which accompanies the accumulation of wealth. This is but a result of the fact that pleasure is more attractive than pain; that enjoyment is preferred to effort, hence the number of the unemployed increases and the amount of effort made for satisfying human wants diminishes.

An important factor of the present situation affecting the high cost of living is the rapidly growing cost of government, national, state and municipal. In case the proceeds derived from taxation are applied to essential improvements naturally no

waste would accrue, but there are nevertheless substantial differences between public and private enterprise. The former is managed with a less degree of care and supervision. Given a certain object, the expense of securing it by public management is usually greater than under private control. There is a still more important factor. The aim and nature of public expenditures differ materially from private investments. The latter are made with a view to an adequate return, a profitable income on the amount expended; in many instances, the former look to objects of a less essential nature, sometimes to monuments of grandeur or of art, which do not subserve any immediate purpose of utility. Public activities are often undertaken for conserving health or maintaining more perfect order and have in view considerations of general welfare most commendable in their nature, but such as would not be initiated in expectation of immediate profit. Again, they oftentimes provide for new facilities on a scale which private enterprise would not attempt. To all these must be added—and especial attention is called to this—the enormous burden of military and naval armaments now amounting, in the more civilized nations, to two billions per year, an economic waste which imposes an almost unendurable burden upon the world's resources. Again in prosperous times a disposition to indulge in excess and unwise undertakings is constantly manifest both in public and private expenditures. So long as there are limitations upon our ability to forecast the future, this will be true. No more helpful consummation in commerce and industry could be wished than that which by careful weighing of future needs and probabilities could adjust present activity to future demand.

In this connection it must be stated that

the inequality of the supplies of raw material requisite for human needs is a prominent factor in the situation. The lumber supply of the United States, which at one time seemed abundant and even inexhaustible, in view of the great demand for buildings, furniture, implements, etc., has been diminished to such an extent as to threaten an early exhaustion. Perhaps the wisest policy would have suggested that the state limit the cutting of timber and require that new forests be planted. However that may be, the diminishing supply of timber in the face of unusual demand has caused a rapid increase in the price of products of the forest, the advance from 1900 to 1910 being the greatest of any single class. A comparison of the figures prepared by the Bureau of Commerce and Labor shows that between 1900 and 1910 the wholesale prices of wooden ware and furniture increased about 20 per cent., while the prices of window glass and grades of earthenware decreased nearly as much. For this divergence there is an evident explanation, namely, that the supply of timber is becoming more scanty while that of sand and clay and other materials for glass and earthenware is inexhaustible and readily available.

There have been numerous illustrations of the increase in prices in the history of progressive countries. According to Boeckh, in the time of Solon an ox in Athens cost 5 drachmas, or nearly 3 shillings, a sheep 1 drachma, a bushel and 3 gallons of corn 1 drachma. Two hundred years later the prices rose to five times and in many cases to ten or twenty times their former amount. The quantity of money was increased by the spoil obtained by successful military operations and by the development of mining in the islands of the Mediterranean, in Attica itself, and in Thrace and the island of Thesos. In

Rome it is more difficult to trace the changes in prices of food. Corn was sometimes exacted as a tribute from conquered countries and sold by the state at less than cost and occasionally given away. The increase of prices was particularly rapid after the concentration of the chief mining industry in the hands of the Roman government. Cattle increased in price as well as corn. About 400 B.C. sheep sold for 7 pence, 3 farthings. At the date of the Christian era the price was 25 shillings. After the Carthaginian wars the Romans acquired the valuable mines of their enemies in the western part of Africa, also in Sicily, Sardinia and the south of Spain. A few years later the mines of Greece and Asia Minor came into the possession of the Romans; still later the mines of Macedonia and Thrace. In their later conquest, special effort was made to acquire supplies of precious metal.

In the year 1581 a dialogue was printed, attributed to one "W. S.," probably William Smith, entitled "A Discourse of the Common Weal of this Realm of England." The participants in the dialogue are a knight or owner of land, supposed to be Mr. Thomas Hales, a doctor of divinity, who, as it is conjectured, was Bishop Hugh Latimer, a husbandman, a tenant farmer, a merchant, a mercer and a capper. An enterprising publisher in the year 1751 republished this dialogue and basing the authorship on the initials "W. S." assigned it to William Shakespeare, a manifest effort to obtain a greater sale by deceit. The real date of the dialogue as appears from more recent investigation was the year 1549. This document is exceedingly valuable for students who are considering the subject of high prices, for if we leave out the influence of the larger aggregations of capital, and the characteristic features of modern business, practically every rea-

son for a rise in prices is advanced in it. Each ascribed to the occupation of the other the responsibility for the existing situation. Views are expressed upon the benefits of protective tariffs against foreign products, upon the balance of trade, upon the exactions of the middleman, upon the increase in rents of agricultural land. One of the characters expresses the opinion that avarice is the cause of high prices. Another mentions the great increase in the cost of necessary articles. One of them says: "Within these 8 years you could buy the best pig or goose that I could lay my hands upon for 4 pence which now costs me 8 pence and a good capon for 3 pence or 4, a chicken for a penny, a hen for two which will now cost me double the money, and it is likewise of great ware as of mutton and of beef." It was maintained in this discussion that price determined rent and not rent price. The husbandman conceded that if he were commanded to sell his wheat and other products at the old price he would have enough to pay his landlord as in times past, but he says that he must buy iron, salt, tar and pitch, all of which brought a higher price than formerly. One cause of the increase of prices, which is pointed out in this dialogue, is the clipping of coin which caused the good coins to go abroad for use in foreign trade. There were, however, more universal causes than this. Bodin, a French political philosopher, of the last half of the sixteenth century, states as an undoubted fact that there had been a revolution in prices. He gives six reasons for it:

1. The great abundance of gold and silver which resulted in a decrease in its purchasing power. The discovery of America and the increase of commerce and the development of banks caused the great abundance.

2. The monopolies of the Guilds and of the tax farmers.

3. The ease with which wine and corn—the chief products of France at that time—might be exported, thus increasing the price at home.

4. The extravagance of the Court.

5. The general leisure in the community.

6. The debasement of money, a practise which was prevalent in France at that time.

Mr. Jacob, in his excellent work on "Precious Metals," ascribes the increase in prices, of which complaint was made in the dialogue referred to, to the increased production of the precious metals and traces with great research the coincidence between their increased supply and the high prices of that time. A similar object lesson in the history of prices is derived from a comparatively recent period. In the years from 1789 to 1809, the average price of commodities rose from an index figure of 85 to 157, or more than 80 per cent. There were many contributing causes, such as the prevalence of war and the interference with international trade caused by the French Revolution and the Napoleonic wars. Mr. Tooke lays stress upon the poor harvests of that period, but Professor Jevons ascribes the increase to the larger production of gold and of silver and points out that metals and oils were more affected than grain. Beginning in 1809, for a period of 40 years, prices fell from an index number, as measured by Professor Jevons, of 157 to 64 or nearly 60 per cent. This decrease has been very generally ascribed to the falling off in the production of precious metals which did not revive until the gold discoveries in California and Australia. There was a temporary rise after 1839, apparently due to the inflow of Russian gold following its discovery in Siberia in 1830. The great activity prior

to 1837 was also a contributing cause. It should be carefully borne in mind that this period from 1809 to 1849 was a time of great industrial advancement in which many inventions and improvements were utilized. In the period from 1849 to 1873, prices rose from 64 to 86, or about 33 per cent. The rise was interrupted by the crises of 1857 and 1866 and greatly accelerated by the exceptional activity prior to 1873 and was presumably due to the gold inflation following the development in 1849 in California and several years later in Australia. In the period from 1873 to 1896 prices fell in gold countries and this is ascribed to the decrease in the production of gold, to the adoption of the gold standard in the more advanced nations, thereby discontinuing the general use of one of the precious metals, at least as far as free coinage was concerned.

Manifestly there were other causes for the decrease in prices at this time. The great increase in facilities for transportation, culminating with the opening of the Suez Canal in 1869, brought different portions of the earth nearer to each other and made it possible to utilize the abundance afforded by outlying districts for the benefit of the more settled areas where food products were becoming less abundant. Again there were most notable increases in the mechanical arts. So considerable was this decrease in prices that several writers, of whom perhaps Mr. David A. Wells is the best example, came to the conclusion that the period of the most buoyant activity had come to an end; that thereafter the people would occupy themselves with repair and replacement or in utilizing discoveries already made. In other words, the most profitable production had reached a limit.

A very valuable contribution to the subject of prices is furnished by a comparison



between gold and silver standard countries. In India, where silver was still the money of the people, the index of prices rose from 107 in 1873 to 140 in 1896. In Japan it rose from 104 in 1873 to 133 in 1896, or a little less than 20 per cent., while in gold-using countries prices fell off more than 20 per cent. From 1896 to 1909 there has been a rise in prices contemporaneously with a great increase in the quantity of gold mined in South Africa and in different portions of the United States and Alaska.

Let us draw a little more fully the comparison between these eras of high and low prices and the production of gold. From 1789 to 1810, it has been stated that there was a rise in prices. During these years the average production of gold in the whole world was a little less than \$12,000,000 per year, and that of silver approximately \$37,000,000, or \$49,000,000 in all. Beginning in the year 1811 the annual average for the next ten years was \$7,606,000 of gold or a diminished supply of more than 33 per cent., and \$22,000,000 of silver, a diminished supply of about 40 per cent. In the following decade from 1821 to 1830 there was an increase in the mining of gold and a decrease in that of silver, but the total annual average was slightly less than from 1811 to 1820. From 1831 to 1840 there was a substantial increase in both metals amounting to about 33 per cent. From 1841 to 1850 gold production increased from about \$13,000,000 per year to \$36,000,000. However, in the forty years from 1811 to 1850, inclusive, an era of low prices, the average annual production of gold was barely \$17,000,000 per year; then with the opening of the mines in California and Australia the average suddenly rose from \$17,000,000 to over \$130,000,000, and to a still greater figure from 1856 to 1860. This was a period of

rapidly rising prices. After this there was somewhat of a decrease. The lowest annual production was for the four years, 1874, 1875, 1876 and 1883, in each of which the production was between ninety and a hundred millions. A practically uniform and very large increase commenced in the year 1891 with \$130,000,000, which increased to the enormous figure of \$236,000,000 in 1897, after which with slight interruptions resulting from the Boer war, the still higher figure of \$454,000,000 was reached in 1909. It thus appears that the production for the single year 1909 was more than two thirds as much as for the forty years from 1811 to 1850. It was greater than the combined coinage value of gold and silver for any year prior to 1898 and five times as great as the production of gold in the year 1874.

A further fact to be taken into account, of course, is the relation of the annual increment to the accumulated supply. Divers estimates of the world's stock of gold have been made. That which should be considered is the portion used for money in the form of coin or bars of bullion. At the present time the annual production is equal to at least three and perhaps four per cent. of the total existing monetary supply. Of the \$454,000,000 mined in 1909, it has been estimated that \$145,000,000 was utilized in the arts. It is probable that this is a large estimate, but in any event the primary money of the gold standard countries was increased by \$300,000,000 in the year 1909. Indeed, according to the very carefully prepared estimate of Dr. Roberts, the Director of the Mint, the amount of coinage for that year is given as \$313,000,000.

It is not by the mere addition of gold to the monetary supply that prices are raised. There is an even more important stimulus to activity in the fact that this money is

used as a basis of credit; that countries which heretofore have been without railroads and modern facilities are enabled to borrow for the construction of great railway lines and public works, the full benefit of which is often for a long time postponed. There is a marked increase in the demand for materials for this work, Labor is more constantly employed and at higher wages. The consuming power of the average human being is greatly increased. Speculation is rife and this tends to raise prices.

The connection between the increased supply of the precious metals and the general level of prices has been so marked and has appeared in so great a variety of countries and of periods as to preclude the possibility of mere coincidence. Of course certain modifying factors should be taken into account. The rise in prices after the beginning of the increase in the supply of gold or silver does not become manifest until some time has elapsed. This can be readily explained, because a substantial increase is necessary to modify the relation between the existing stock of the precious metals and the accretions.

Again, there has usually existed a concurrence of factors which make for increased activity and rising standards of living, on the one hand, and the increased supply of the precious metals, on the other. The development of gold mining on a large scale has followed closely after discoveries and inventions. This concurrence is such that while it would hardly be safe to generalize upon it, there is a strong presumption of a connection between the two. A somewhat similar cause of the rise of prices, by reason of the increased supply of gold among the militant countries of the ancient world, may be traced in their activities to secure the control of mines from which the precious metals were obtained.

The foregoing facts emphasize the importance of the so-called quantitative theory of money in considering the question of prices. To give adequate treatment to this theory and to estimate the effect of the volume of money upon prices would prolong this paper to an undue length. It would manifestly be incorrect to state the relation of the volume of money in circulation to the general level of prices as a simple equation. The problem is much more difficult. On this subject Mr. John Stuart Mill wrote in his work on Political Economy:

The proposition respecting the dependence of general prices upon the quantity of money in circulation must be understood as applying only to a state of things in which money—that is, gold or silver—is the exclusive instrument of exchange, and actually passes from hand to hand at every purchase, credit in any of its shapes being unknown. When credit comes into play as a means of purchasing, distinct from money in hand, the connection between prices and the amount of the circulating medium is much less direct and intimate and such connection as does exist no longer admits of so simple a mode of expression.

Certain modifications are necessary in order to harmonize the quantitative theory with modern conditions. Only the amount of money actually in circulation can have any effect upon prices. That hoarded or out of circulation for other reasons can not exert any influence. On the one side, account must be taken of the variations in volume of transactions during periods of prosperity or depression and even at different seasons of the year. This factor affects the demand for the medium of exchange. On the other side, allowance must be made for the rapidity of circulation and the use of credit instruments which reinforce the monetary supply and thereby modify its influence upon the price level.

There are sundry current explanations of the present high prices which may be readily dismissed as untenable if advanced

as a reason for the general rise in the price level, however applicable they may be to the increase in the price of specific articles. What shall be said of the influence of the so-called trusts on prices? It is clear that complete monopoly or preponderant control of the market in the production or sale of any particular commodity affords opportunity to increase its price. The same result is apparent when separate producers maintain an agreement or understanding as to prices.

On the other hand, the superior economy and efficiency of large scale operations materially diminishes the cost of production and even more of distribution and should therefore tend to decrease prices. For this reason the concentration of industrial and commercial enterprise is a legitimate phase of business evolution. It must be said, however, with equal emphasis that thus far the general public has not experienced in reduced prices the benefit to which it is entitled because of the increased economy and efficiency resulting from great combinations. If the people do not receive their proper share of the benefits, strict control beginning with greater publicity and ending perhaps with the regulation of prices is the inevitable outcome. Certain it is that large scale operations have come to stay. If they can not be successfully regulated, it is probable that state ownership will be adopted in preference to a return to the old régime of smaller competing units.

In a majority of cases the statistics of prices do not bear out the assertion that the establishment of large corporations has always caused an exceptional increase in the cost to the consumer. In many instances, the higher prices are due in part at least to the greater expense of obtaining raw materials or to the increased labor and obsolescence charges to which all concerns

of whatever magnitude are alike subjected. In the table prepared by the statistician of the Department of Agriculture, to which reference has been made, it appears that among over eighty enumerated articles purchased by the farmer, there were only three, the cost of which diminished between the years 1899 and 1909. Two of these are comparatively unimportant, the third is coal oil, which fell off from 15.1 cents per gallon in 1899 to 14.2 cents in 1909. There were also substantial reductions in the prices of various forms of iron and steel in the same period, while, as already mentioned, those of practically all the agricultural products of the temperate zone increased.

The rise in the price level can not be ascribed to tariffs any more than to the trusts, though prices of particular articles may have been increased by them. In answer to those who maintain that the tariff is responsible for the high cost of living in the United States, attention may be called to the admitted fact that the rise in the price level has been universal under free trade, as well as under revenue and protective tariffs. In a single newspaper published at Paris last September, there were paragraphs giving accounts of meetings, some of which were attended by violence, in Berlin, Switzerland, Bohemia, Silesia and Galicia to protest against high prices. In other issues at about the same time there were paragraphs giving accounts of bread riots in France and of loud complaints against the high cost of living in England and Belgium.

It is a noticeable fact that many prices have risen in spite of reduced tariffs in our own country, as in the case of hides and shoes. In the whole list of increases in prices from 1899 to March, 1910, there is no more notable illustration than that of crude rubber, on which there is no duty.

The price rose from 80 cents in the former year to \$1.99½ in 1910. On the other hand, raisins and prunes, upon which there is a considerable duty, have shown a material fall, and sugar has not greatly increased in price except very recently, due it is claimed, to crop conditions. Instances might be indefinitely multiplied of the rise and fall of prices here and elsewhere irrespective of the duties levied. These illustrations show that the tariff is only one of the numerous causes affecting relative prices. It may often happen, as in the cases cited, that other causes so far outweigh the influence of the tariff that its effect can not be discerned.

As regards the cost of labor, while a high standard of wages is maintained in the United States and there have been notable increases in the wages of many classes of employees, it can not be said that there has been a disproportionate increase; the facts are quite the contrary because, generally speaking, the cost of living has more than kept pace with the increase in compensation.

As a rule, wages as well as retail prices do not immediately respond to changes as readily as wholesale prices or as rent and other items which make up the ordinary expenses of living. The basic fact which should be considered is the relative proportions of personal service and of improvements accomplished by inventions or labor-saving devices, in the production or distribution of any commodity. In cases in which machinery renders a more efficient service than formerly, the tendency is toward downward prices, but in case labor or personal service has been only partially aided by these improvements, or as in some cases not at all, the prices have increased.

Under modern systems of distribution the amount of personal service required is

relatively much greater than formerly and in this fact may be found a very important cause of high prices. Much more care is exercised in the preparation and handling of packages. Delivery is made to the consumer at his residence. There is no sufficient organization in distribution. As a result there is a vast amount of duplication. This service involves an exceptional cost as compared with the work of distributing large quantities. For example, the carrying of a ton of coal 150 miles to a city costs less than the transfer of that coal for a half or even a quarter of a mile to the home in which it is consumed. The cost of delivery of mail matter by carriers in cities and on rural free delivery routes is much in excess of the carriage in bulk by railway or steamship, even for very long distances.

Innumerable examples may be given of the very considerable difference between the original cost to the manufacturer and the final charge to the consumer. Some weeks since figures were carefully prepared in regard to the manufacture and sale of an article of clothing now in very general use. The manufacturer charged \$24.90 per dozen. Each dozen included different sizes. The retailer charged from \$4 to \$10 per garment. The total sales averaged about \$6.50 for each, or a total of \$78 to the consumer as against \$24.90 to the manufacturer. The retailer is not to be blamed. The pressure of population in cities, the greater demands of modern life resulting in higher rents and higher cost for services rendered to him, make it essential that he should charge more for the goods he sells.

An entire revolution in methods of distribution is imminent. The consumer will be brought nearer to the producer. Great warehouses will be substituted for small and scattered shops, especially in case of

staple articles where confidence in the seller or exceptional skill are not essential features. The possible economy of large-scale production and the undertaking by one organization of the various processes, even from the raw material through manufacture and distribution to the consumer, has been demonstrated by some of the great corporations of the country. However much we may decry this tendency, we may be reasonably certain that it will be adopted more and more in the future.

It would be rash to predict an early return to low prices. All the great factors which I have partially portrayed depend upon new conditions which have arisen, some of which are inseparably connected with substantial benefits to the human race. If prices have increased, human enjoyment has increased also.

That which is most noticeable in the consideration of this problem is the wide variation in the changing cost of divers commodities and facilities. After making due allowance, however, for this variation, there is a manifest increase in the general price level. Great economic laws will be potent in their effect upon these conditions. The enormous increase in the production of gold will be checked as this metal becomes less valuable in comparison with useful articles. Indeed, this fact is already forecast by the diminished annual increase in the years 1910 and 1911. The increasing price of farm products may stimulate a "back to the farm" movement, but whether this proves true or not it will undoubtedly encourage more scientific methods of cultivation and thus increase the average yield per acre. More intelligent and more adequate control will be exercised over great industrial and commercial organizations so that the benefit of modern developments in industry and

commerce may accrue in proper measure to all classes of consumers.

The same advances which have been made in production and in the distribution of great masses of commodities will, as far as possible, be applied to the minutest details of distribution. Our natural resources which have been wasted, or too largely absorbed by the few, will be more carefully utilized and every possible means be taken to preserve a proper share of them for the future. Thus in this present increase of prices as in all great economic changes there may be reasonable assurance that the ultimate effect will bring to all substantial benefit rather than harm.

T. E. BURTON

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*THE CENTENARY OF THE ACADEMY OF  
NATURAL SCIENCES OF PHILADELPHIA*

EARLY in the past year resolutions were adopted by the council of the Academy of Natural Sciences of Philadelphia approving of a fitting celebration of the centenary of the society on the nineteenth, twentieth and twenty-first of next March. The president appointed a committee of forty-one to make arrangements for such celebration.

The general committee, of which the president, Samuel G. Dixon, M.D., LL.D., is chairman, has been divided into sub-committees on printing and publications, meetings and addresses, invitations, finance and entertainment. In harmony with a preliminary report of this committee the publication of three volumes has been decided upon: A commemorative quarto volume of scientific memoirs, adequately illustrated; an index to the series of *Proceedings* and *Journal* up to and including 1910, now amounting to nearly one hundred volumes, and a detailed history of the academy by Dr. Nolan, of which the chapter contributed by him in 1908 to the "Founders' Week Memorial Volume" may be considered a prodromus. The last mentioned volume will be illustrated by portraits and views.

It has been decided to hold the first session on the meeting night of the academy, on